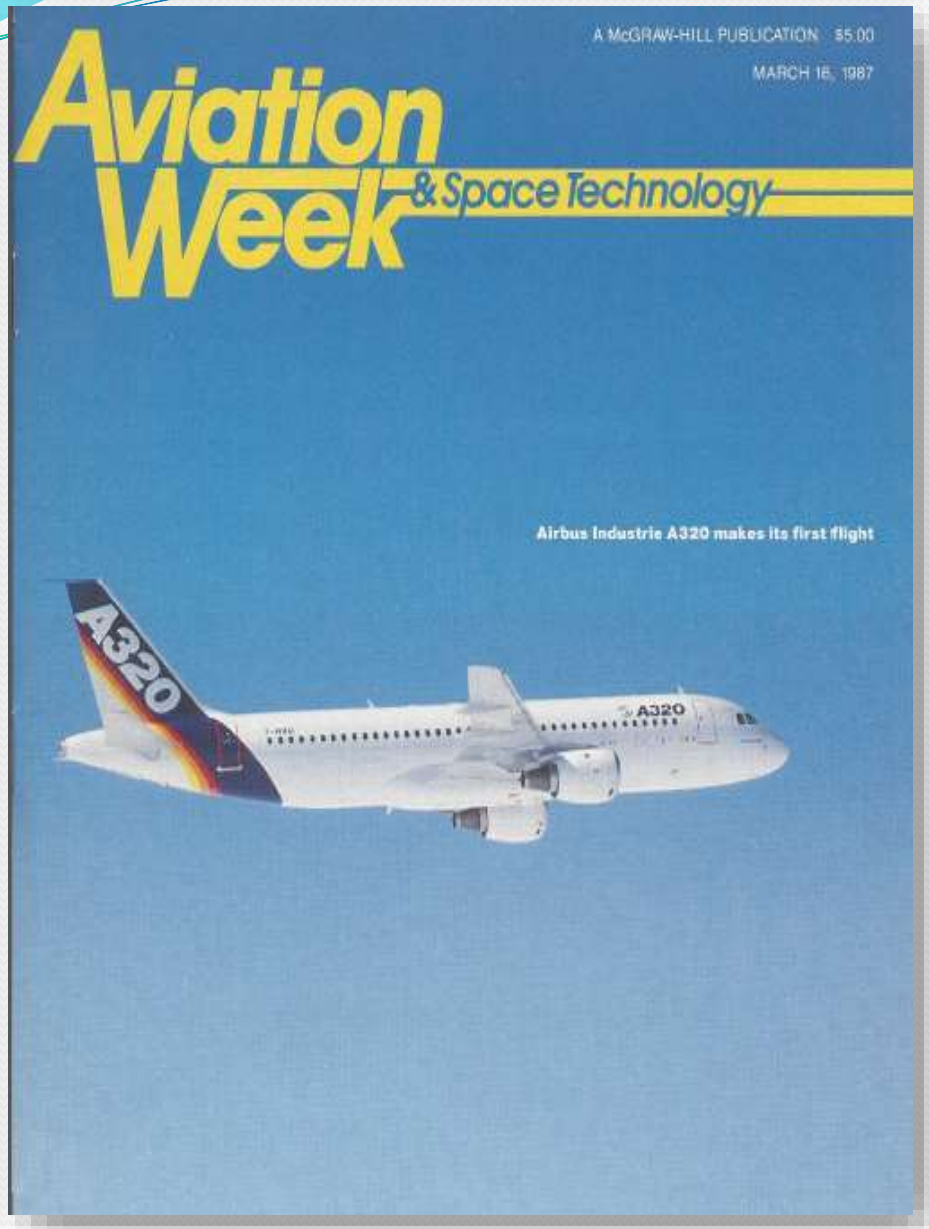
International Conference:
Will Air Transport be Fully Automated by 2050?

Perspective of a former airline pilot, researcher, and current NTSB Board Member

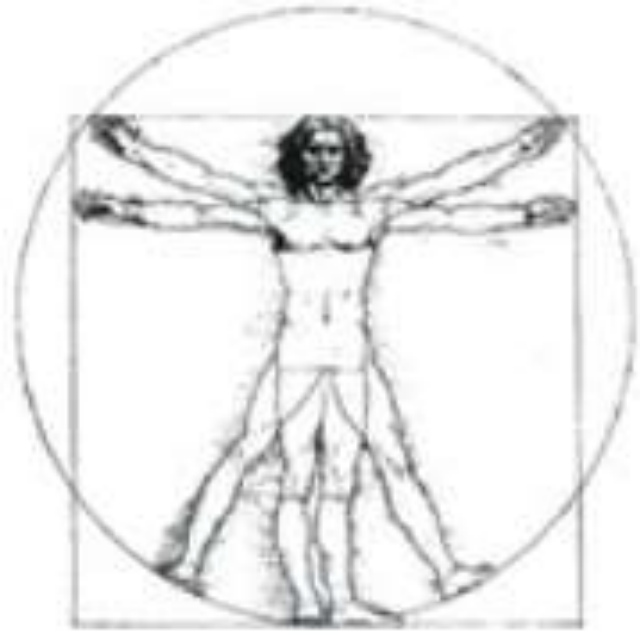
Robert L. Sumwalt
Foreign Associate Member, AAE



30 years can pass very quickly!!

2050 isn't really that far away!!

Human factors considerations for automation



"Once you put pilots on automation, their manual abilities degrade and their flight path awareness is dulled: flying becomes a monitoring task, an abstraction on a screen, a mind-numbing wait for the next hotel."

- William Langewiesche, *Vanity Fair*, October 2014

Research conducted in 2014

- 110 NASA ASRS reports
- 25 accident reports

Facts:

- Humans are not good at monitoring highly reliable, highly automated systems for extended periods of time.

  - 42 accidents in 35 years
  - These accidents claimed **894** lives and resulted in **180** serious injuries

In 104 ASRS reports, who or what first detected the flight path deviation?

Deviation first detected by:	Number of ASRS Reports
ATC	49
Cockpit alerting system	22
Jumpseat rider	1
Crewmember	32

72

- Someone or something other than the operating crew first detected the flight path deviation in 72 of 104 reports.
  - $\chi 2 = 15.39$, $df = 1$, $p < 0.001$.

"If automation is highly but not perfectly reliable in executing decision choices, then the operator may not monitor the automation and its information sources and hence fail to detect the occasional times when the automation fails"

- Raja Parasuraman, 2002

Asiana 214 – San Francisco

July 2013

U.S. NEWS
Pilots Cited in July Jet Crash
Pilots said to err in properly monitoring speed and trajectory.

"Human factors research has demonstrated that system operators often become complacent about monitoring highly reliable automated systems when they develop a high degree of trust in those systems and when manual tasks compete with automated tasks for operator attention."

- NTSB report of Asiana crash

"The PF, PM, and observer believed the A/T system was controlling speed with thrust, they had a high degree of trust in the automated system, and they did not closely monitor these parameters during a period of elevated workload.

Thus, the flight crew's inadequate monitoring of airspeed and thrust indications appears to fit this pattern involving automation reliance."

- NTSB report of Asiana crash

Barriers to Effective Monitoring

- Boredom
- Complacency
- Fatigue
- Time Pressure
- Mental workload
- Lack of vigilance
- Looking without seeing
  - Inattention blindness
  - Change blindness
- Poor workload management/ task allocation

Change Blindness

"People are surprisingly poor at detecting even gross changes in a visual stimulus if they occur in objects that are not the focus of attention."

- S. Palmer, 1999, *Vision Science*.

MACH
ALT CRZ
NAV
AP1
1FD2
A/THR
280
260
240
220
375
370
365
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MACH
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Inattentional Blindness

Inattentional Blindness

Poor monitoring of airspeed

- **<u>Airspeed</u>** was the leading category of flight path parameters not monitored in the researched **accidents**.
  - 10 speed deviations (40% of 25 accidents)
  - 6 accidents involved low speed situations on approach (24% of 25 accidents)

Suggestions

Maintain considerations for human factors when designing future aircraft. Understand limitations on human abilities to monitor highly automated systems.

Develop dependent low energy alert systems to provide advance warning of low situations.

Don't automate simply because you *can* automate.

"We can design for anything we can think of, but we can't think of everything."

- John DeLisi, Director of NTSB office of aviation safety

Accident investigation considerations for 2050

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Flight MH370
Beijing
CHINA
TRAVEL ROUTE
East China Sea
South China Sea
MALAYSIA
227 passengers
including two infants
12 crew members

MISSING EGYPTAIR FLIGHT
PARIS
FRANCE
CAIRO
EGYPT

skyNEWS .com.au
BREAKING NEWS
MISSING AIRCRAFT
AIRASIA STATEMENT: WE REGRET THAT FLIGHT QZ8501 FROM SURABAYA TO SINGAPORE LOST CONTACT WITH TRAFFIC CONTROL

Going from this…

To something like this.

Challenges

- Access to, and protection of data.

Thank you.